

A Policy Study on the Implementation Challenges of Phytosanitary Standards: The Case of ISPM 15 in Botswana, Cameroon, Kenya and Mozambique [†]

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Biographical sketch

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Abstract

The rise in international trade in recent decades has been accompanied by an increase in the movement of wood packaging materials. Recognizing the associated threat of cross-border pest movement, the Commission on Phytosanitary Measures, the governing body of the International Plant Protection Convention, adopted the International Standard for Phytosanitary Measures (ISPM) 15 (Guidelines for regulating wood packaging material in international trade) for the treatment of wood packaging materials (ISPM 15). The objective of this paper is to raise awareness on the challenges four sub-Saharan countries -Botswana, Cameroon, Kenya and Mozambique- are facing when it comes to implementation. During extensive fieldwork, we conducted interviews with key stakeholders to understand their role in the set-up and implementation of the standard, as well as their perceptions on relevant challenges. Addressing these challenges is vital for achieving compliance and removing associated institutional and economic barriers. The paper can assist policy-makers and academics to design future policies that tackle implementation problems, especially in the context of developing countries.

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Introduction

The extent of globalization has dramatically increased the magnitude of international trade, with overall exports accounting nowadays for almost 50 percent of global production (WTO, 2015). This has been accompanied by a parallel increase in the use of wood packaging materials (WPMs), which facilitates the cross-border movement of bark and wood-boring pests (Roy et al., 2015). The correlation between the increase in the use of WPM for trade and the introduction of new pests has been reported to be positive and significant (Ciesla, 2004). As the European interception data for the period 1995–2004 suggest, WPMs account for 73 percent of the pathways by which pests are introduced into new geographical areas.

While non-native species introduced outside their natural habitats do not necessarily cause problems in their new locations (Williamson, 1997), the majority of newly introduced (and often invasive) species are now known to be highly destructive for the environment and for the biodiversity of the hosting countries (Jackson, 2015; Mack et al., 2000; Nghiem et al., 2013; Pimentel, 2011). The economic impacts of pest spread include lost profits to farmers, non-market costs (such as the foregone profit on the recreational use of forests and landscape) as well as the irreversible damage caused to ecosystems (Aukema et al., 2010). Anderson et al. (2004), for example, estimate that the pre-harvest pest and disease damage in eight of the most important food and cash crops is valued globally at 300 billion USD. The study by Aukema et al. (2011) estimates the more localized environmental damages caused by the invasive tree borers in the US to be about 2 million USD each year (Aukema et al., 2011); the yearly damages in Europe due to invasive alien species and the costs of control measures are estimated to be even higher and close to 10 million USD (Kettunen et al., 2009). Soliman et al. (2012) claim that, in the absence of any regulatory measures in place, the

cumulative cost of lost forest cover over a period of 22 years (from 2008 to 2030) would amount to 26 billion USD. Studies conducted in Australia, Brazil, India, South Africa, United Kingdom and the US in 2001 (then repeated in 2005) computed the costs of newly-introduced pests to be approximately 256 USD per capita per year (Pimentel et al., 2001, Pimentel, Zuniga, & Morrison, 2005). Assuming costs of similar magnitude are faced worldwide, Pimentel et al. (2001) estimate that the global damage from pests may amount to approximately 1.4 trillion USD per year, or nearly five percent of global GDP. The negative externalities can also extend to the human health domain, with pests being vectors of diseases or causes of allergies (Pimentel et al., 2005, finds a higher mortality rate due to cardiovascular diseases in areas infested with the Emerald ash borer).

The introduction of the International Standards for Phytosanitary Measures (ISPM) represents an attempt by the International Plant Protection Convention (IPPC) and its member states to set out the basic rules for food safety and animal and plant health standards (Clarke, 2004) (1). Within this context, the International Standard for Phytosanitary Measures No. 15 (ISPM 15) was explicitly introduced for the treatment of wood packaging materials and the prevention of associated cross-border pest movements (ISPM 15, 2009). The importance of the ISPM 15 is underlined by the sheer number of WPM being moved each day. Recent statistics suggest that between 50 and 80 percent of the world's merchandise trade is transported with the use of WPM (Strutt, Turner, Haack, & Olson, 2013). Some available statistics from the packaging industry in the US suggest that more than 15 million cubic metres of solid wood was used in 1999 alone for the construction of WPM (Haack et al., 2014).

Unsurprisingly, the implementation of the ISPM 15 comes with costs –setting up treatment facilities, instructing auditors to monitor their compliance and training customs officials to inspect WPM- which can be particularly high for developing countries (which often face a limited endowment of resources and technical knowledge). Some of the major challenges relate to the lack of technical expertise and appropriate technologies, limited financial resources, the existence of incompatible production systems and logistical problems (Henson, Brouder, & Mitullah, 2000). A case study by Hassler, Grushecky, Slahor, and Turk (2010) found that the implementation of ISPM 15 increased, on average,

the cost of a single wood pallet by approximately 0.60 USD (with this amount varying across countries, depending on the technology and type of treatment adopted). The rise in the price of treated WPM (varying from country to country) increases the cost of traded goods and may change the set of comparative advantages a country has in particular sectors, creating hence winners and losers in international markets (Beghin & Bureau, 2001).

The implementation of the ISPM 15 comes with benefits too; countries correctly implementing the standard can trade with the rest of world. In this sense, the rationale of the standard is not to alter the international market share exporters have gained over time. The benefit of implementing the standard does not accrue only to exporters but to the overall society; the objective of the standard is to reduce the introduction of pests which have proved to cause severe damages at the level of the ecosystem and pose a threat to agricultural yields.

To our knowledge, this is the first in-depth analysis on the implementation challenges of the ISPM 15 in the context of sub-Saharan Africa. Our study relates to (and builds on) existing research in the fields of regulation and governance, governance capacity and value chain governance (especially in the context of developing countries). The market for ISPM 15 compliant pallets involves a series of (domestic and international) buyers, sellers and regulatory institutions that interact with one another at different stages of the value chain – actors within the value chain monitor and facilitate compliance with rules that dictate what should be produced (product design/specifications) and how (labor/environmental standards, use of technologies etc). There is an extensive literature on the multiple challenges (and disadvantages) that developing countries face within existing governance structures (related to the setting and implementation of standards). To a large extent, the main drivers of international standards have traditionally been governments and firms in developed economies; although existing power relations change (especially with the larger participation of China and other newly industrialized economies in global value chains), many exporting firms and governments in the developing world still find it difficult to voice their concerns and influence processes regarding standard setting and implementation (Henson and Humphrey, 2010). In addition, the associated costs

of standard compliance reduce the ability of developing countries to remain competitiveness in export value chains (which is especially the case for small-scale firms, see Graffham, Karehu, & MacGregor, 2007; Linqing, Liwen, & Haiyan, 2011), unless there is parallel donor assistance in place (in the form of technological transfers or financial support; Humphrey, 2008). Furthermore, compliance with and enforcement of regulations is also largely hindered (especially within the context of developing countries) by *regulatory capture* (where regulators, influenced through lobbying or financial incentives, act in the interest of pressure groups within the industry rather than the public interest), weak rule of law systems, limited monitoring capacity, informational barriers and behavioral and organisational constraints that limit changes in long-established practices (see Dubash & Morgan, 2013; Iwaro & Mwasha, 2010; Molinuevo & Sáez, 2014).

Our qualitative research is based on extensive fieldwork undertaken during the period 2015-16 in Botswana, Cameroon, Kenya and Mozambique and a series of in-depth interviews with several key stakeholders (pallet manufacturers, government/customs officials, representatives from several industries, etc). The choice of the four countries is based on the fact that the National Plant Protection Organizations (NPPOs) of those countries –among all in the sub-Saharan region- explicitly expressed interest in participating in our study (on evaluating the implementation of ISPM 15). We carried out a thorough review of associated procedures and common practices in place, with particular emphasis on issues of compliance across all actors in the WPM value chain (WPM treatment facilities, exporters, government departments, customs, etc). Overall, our findings point to several crucial malpractices that pose serious challenges to the successful implementation of the ISPM 15. While some of them are country-specific, in large these tend to be common across all four countries. These malpractices relate to the proper application of the ISPM 15 mark, lack of awareness of appropriate WPM treatment, insufficient coordination at multiple levels, inadequate allocation of resources and limited competency of treatment facilities.

The content of this paper aims to raise awareness among government representatives, United Nations officials, academics and scientists on the challenges these countries –and maybe other countries as

well- may face when it comes to complying with an international standard. In that respect, the recommendations drawn later on can constitute the basis for policy changes at the country, regional or global level.

The rest of the paper is structured as follows. Section 2 provides an overview of the ISPM 15 and the key implementation milestones since its inception in 2002. Section 3 discusses national legislation and procedures that our four case study countries have put in place to facilitate ISPM 15 implementation. Section 4 briefly describes our methodological approach, while the following section draws on our fieldwork and presents our key findings regarding the implementation challenges these countries currently face. Policy implications/recommendations and concluding remarks are presented in Sections 6 and 7.

Overview of the ISPM 15

The ISPM 15, approved in 2002, represented the international response to phytosanitary threats posed by untreated WPMs. This was a rather atypical phytosanitary standard at the time, given its focus on regulating the packaging materials used for international trade, rather than the traded commodities directly. Table 1 provides a graphical representation of the evolution of the standard since its inception.

<Table 1 about here>

The stated objective of the ISPM 15 is to “reduce significantly the risk of introduction and spread of most quarantine pests” (2). For this purpose, there are currently three recognized treatments: two types of heat treatment (standard heat treatment –HT– and dielectric heating –DH) and a fumigation treatment using methyl bromide (MB); the ISPM 15 recognizes all three treatments as equally effective. Every WPM treatment facility has the liberty to choose any of these three recognized treatments; in practice, however, most of the WPM treatment facilities located in developing countries use the HT and the MB treatment (3). Additional methods of treatments have also been

submitted for consideration and may be approved for use in the future. For instance, sulphuryl fluoride was recently adopted by CPM-13 (late 2018) as another alternative treatment.

The HT (as prescribed in the 2002 version of ISPM 15) called for a minimum temperature of 56°C to be reached and held for 30 minutes, as measured at the core of each piece of wood. In 2009, the required duration of heating was amended to “30 *continuous* minutes” throughout the entire profile of the wood, including the core. The main disadvantage of heat treatment (in comparison to other methods) is the relatively high set-up costs involved (i.e. the purchase and operation of energy-intensive heat chambers). As the work by Henin, Charron, Luybaert, Jourez, and Hebert (2008) points out, the estimated cost per treated pallet can be as high as 2 USD. There are also concerns regarding the effectiveness of the treatment, as it is difficult to ensure whether a piece of wood or pallet has been effectively treated without using appropriate equipment (4). The DH treatment (based on electromagnetic energy as in microwave ovens) was added as an alternative method in 2013, although its use remains rather limited.

MB has been widely used (already since the 1930s) for quarantine treatment purposes due to its capacity to kill pests rapidly with supposedly limited contamination of commodities (Fields & White, 2002; Henin et al., 2008). As reported by Fields and White (2002), “[MB] acts rapidly, controlling insects in less than 48 hours”. However, the use of MB treatment is declining due to its depleting effect on the ozone layer (Fields & White, 2002); its use for quarantine purposes is still allowed in developing countries under the Montreal Protocol agreement (United Nations Environment Programme, 1992). The 2002 regulation required an exposure time of at least 16 hours; the 2006 revisions extended the minimum limit to 24 hours. Evidence suggests that exposure to MB is lethal for most living organisms, although treatment success is highly dependent on the proper application of the fumigant.

Treated WPM needs to be marked to demonstrate that it has undergone one of the approved treatment methods. The ISPM 15 mark must include the ISPM 15 symbol, a two-letter country code which identifies the country where the treatment took place, the number assigned by the NPPO to

the WPM treatment facility, and a two-letter code for the treatment used. The mark must be legible, permanent and not transferable, and placed in a visible location, preferably on at least two opposite sides of the wood packaging unit. Figure 1 provides an example of the information that the ISPM 15 mark should display. While FAO authorizes NPPOs to use the symbol, FAO retains the ownership of the symbol and should be contacted if the symbol is used in fraudulent circumstances. The application of the mark makes the use of a phytosanitary certificate unnecessary, as the mark indicates that the approved phytosanitary measure (treatment) has been applied. Therefore, treated WPM should be accepted at the point of entry without the need for further documentation and controls.

<Figure 1 about here>

Prior to 2009, the standard placed no specific limitations on the use of non-debarked wood; however, countries could request imported WPM to come from debarked wood, provided that there was a scientific justification in support of this. The 2009 revision of the standard stated that the WPM had to be made of debarked wood, regardless of the treatment chosen, as the use of debarked wood is expected to enhance the effectiveness of the treatment.

The standard also regulates the treatment of repaired WPM. According to ISPM 15, any WPM for which a third or less of the wood has been replaced is referred to as “repaired WPM”. If only treated wood is used for the repair of damaged WPM, no further treatment is required (although the ISPM 15 mark must be added to each new component). The mark of the original certification of the unit should also remain on the unit, unless the entire unit is retreated. However, the presence of multiple marks may pose problems in identifying the origin of the unit in cases of pest interception. WPM, for which more than a third of its original components have been altered, needs to be retreated in full (with all previous marks removed and the new one applied to the unit) (IPPC Secretariat (2017).

Facilities treating WPMs are required to maintain treatment records and comply with inspections by the national auditing agency (i.e. the NPPO or a delegated entity). During an inspection, which may be scheduled or unannounced, the inspector samples wood packaging material to determine if this has

been properly treated and correctly marked (5). When sampled WPM is found to be non-compliant with ISPM 15, all stored WPM is withheld for additional inspection.

The standard regulates WPM used both for exported and imported goods. Compliance in the case of exports allows implementing countries to access markets with stringent environmental regulations. Naturally, it is in each country's best interest to ensure that all WPM used to transport imported goods is also checked for ISPM 15 compliance (in order to prevent the introduction of new pests to local ecosystems). The way inspections are organized differ from country to country; interviewed customs officials of the 4 countries mentioned that it is often common practice that only WPM carrying imported goods from countries perceived as 'high risk' are thoroughly inspected.

Stylized Facts About The Implementation Process In The Four Case-Study Countries

The Inter-African Phytosanitary Council (IAPSC) serves as the regional plant protection organization (RPPO) which coordinates activities in the domain of plant health management across its 55 African member countries. The mandate of the IAPSC is to harmonize plant protection related procedures in all African member states and ensure high standards of nutrition, food safety and availability for a growing population. Its activities range from managing plant protection activities and organizing training on phytosanitary matters, to updating pest lists for country NPPO inspectors. Furthermore, the IAPSC helps NPPOs in the African region to undertake awareness campaigns on phytosanitary issues and facilitates cross-country collaboration among African partners (FAO, 2006).

However, IAPSC does not meet, to a large extent, expectations regarding its coordinating role and practical involvement in plant protection; the organization fails to provide in-depth regional guidelines that would help harmonize the implementation of phytosanitary-related legislation across member states. This lack of guidelines affects the implementation of and the compliance with the ISPM 15 in numerous ways. For instance, IAPSC does not set any common rules concerning the frequency and type of inspections that NPPOs should carry out for imported WPMs. Furthermore, IAPSC does not

keep a record regarding the implementation timeline of the standard across its member states. This information could be instrumental in better tailoring region-specific interventions, identifying best practices and detecting implementation challenges within the SSA context. So far, and to the best of our knowledge, IAPSC has not carried out any in-depth comparative assessment of the standard and its impacts on local ecosystems and economic activity across sectors. This *lassaiz-faire* practice is in stark contrast with the way the EPPO (the European Plant Protection Organization) functions as it provides concrete guidance to its European member states and NPPOs on the implementation of the standard (e.g. in relation to the choice of treatments, the number of required audits and the type of mandatory documents WPM treatment facilities need to provide to receive authorization) (7).

This lack of regional coordination is reflected in the substantial differences (with respect to ISPM 15 implementation) observed across IAPSC member states. The text that follows provides an overview of the heterogeneity in national legislation and procedures that our four case study countries (Botswana, Cameroon, Kenya and Mozambique) have put in place to facilitate ISPM 15 implementation and compliance. Table 2 summarizes the details of the implementation process in the four countries.

<Table 2 about here>

NPPO in Botswana

The Government of Botswana has enacted two legislative decrees related to the management of plant pests: the Agrochemicals Act of 2000 and the Plant Protection Act of 2009 (with the latter legislation following the adoption of the ISPM 15 by national authorities in 2006). The NPPO, which is part of the Ministry of Agriculture and Food Security, is the institution responsible for the management of plant pests and for setting up all necessary procedures for the implementation of the ISPM 15. The lack of dedicated financial and human resources has, however, inhibited the effective enforcement of the newest national legislation (and consequently weakened ISPM 15 compliance). In practice, the enforcement of the standard by NPPO officials has been rather limited; for instance, NPPO staff rarely

carry out inspections of goods, either entering or leaving the country. When inspections take place, these are carried out at random in a rather *ad-hoc* basis, since there is no national guidelines manual to instruct inspectors on what procedures to follow. Consequently, such cases of poor implementation of the standard compromise the overall effort to protect local ecosystems against the introduction of foreign pests.

Since 2006, only one WPM facility has received authorization (by the NPPO) to treat wooden pallets that comply with the standard (and hence bear the ISPM 15 mark). Botswana-based exporters can buy treated WPMs from this local facility or can import them from foreign countries. The facility treats WPM using MB; there is currently no contingency plan in place as to what will happen when MB is phased out in the near future (although the deadline has been pushed back several times). While the NPPO is obliged to audit the facility regularly, NPPO officials have confirmed that inspections have been done irregularly throughout the year.

NPPO in Cameroon

The Cameroon Ministry of Agriculture and Rural Development signed in 2006 the legislative decree 003/06/A/MINADER/SG/DRCQ/SDRSQV/SQV, which laid down the procedures for processing WPM (used for international trade) in compliance with ISPM 15. Formally, the Ministry of Agriculture and Rural Development is the official implementing agency, although it delegates its authority to the NPPO. Consequently, the NPPO prepared an “inspection protocol for phytosanitary treatment facilities”, which provides concrete national guidelines to its inspectors on how to assess the ability of each facility to safely and efficiently conduct ISPM-15 compliant treatments. The protocol covers all necessary aspects and phases of the inspection (ranging from way the mark is applied to the safety of the equipment and the involved personnel). Upon a successful inspection, the Cameroon NPPO issues licenses for approved WPM treatment facilities (treating WPM with either HT and MB); each license has a validity of 5 years (which can, though, be renewed once the facility is re-inspected by NPPO officials). However, in practice, NPPO officials do not strictly adhere to the protocol-prescribed

instructions. For instance, while the protocol requires officials to carry out yearly audits, these are rarely enforced. In the same vein, although the authorities (at last in theory) support the gradual phase-out of MB, no concrete steps have been taken in this direction. On a more positive note, the NPPO finalized in 2017 a (guidelines) manual on how to conduct inspections of imported consignments and their WPM (in order to prevent that these are carried out in a rather ad hoc manner).

NPPO in Kenya

Kenya initiated ISPM 15 implementation in 2006 with the NPPO (the Kenya Plant Health Inspectorate Service - KEPHIS) as the implementing agency; broad national guidelines related to the implementation of phytosanitary measures were laid out in the Plant Protection Act CAP 324 of 2009 and in the KEPHIS Act No.54 of 2012. These guidelines were rather generic providing little ISPM-15 specific guidance; a new draft regulation is currently under consideration with the aim of explicitly strengthening the enforcement of the ISPM 15. At present, there is no ISPM-15 manual that sets out detailed national guidelines and instructions for NPPO officials to follow.

WPM treatment facilities need to submit an application to KEPHIS to receive authorization. The application dossier should include a number of supporting documents (e.g. a certified copy of the company's registration certificate and associated permit to use chemicals, details of the location of the facility etc). The authorization lasts for one year and the license is renewable upon a satisfactory evaluation of the facility. The auditing process involves KEPHIS officials inspecting sampled WPM, assessing the way treatment methods are carried out (either HT or MB), as well as reviewing how treated WPM is stored (i.e. whether it is separated by at least five metres from untreated WPM). Guidelines for imported WPM in Kenya tend to be less strict, as there are no specific procedures explicitly regulating the type and frequency of inspections.

NPPO in Mozambique

Mozambique has been implementing the standard since 2009, with the NPPO acting as the implementing agency (with the support of human and financial resources from the Plant Protection department of the Ministry of Agriculture). Each WPM treatment facility need to submit an application in order to receive authorization by the NPPO. The request needs to be accompanied by the official registration certificate of the company (provided by the Ministry of Trade and Industry) and documentation related to the design of the facility (containing a description of the available equipment, the adopted treatment methods etc). An NPPO team (consisting of one technician from the quarantine sector and one from the agrochemicals registration and control sector) then visits the facility and conducts an inspection to verify that ISPM 15 compliant procedures are in place. There are currently four ISPM-15 compliant WPM treatment facilities operating in the country. Three of them are basically exporting companies which have in-house facilities to treat own WPM used for their exporting consignments (with only one facility, hence, selling treated WPM to other firms). The NPPO acknowledges that inspections of imported WPM remains the weakest aspect of the ISPM 15 implementation (with inspections taking place infrequently as a result of limited dedicated resources).

Methods

The research team conducted *stakeholder analysis* (with the help of local NPPO representatives) to identify key actors whose interests, knowledge and importance are likely to play an instrumental role in the successful implementation (or not) of the standard. The stakeholder mapping exercise involved classifying relevant stakeholders in terms of their *power* to influence the standard adoption/implementation as well as overall *interest* in these processes (for similar applications of this methodology, see Cairns, Goodwin, & Wright, 2016; Pacagnella, Porto, Pacífico, & Salgado, 2015). During fieldwork, we conducted semi-structured interviews with these key stakeholders (both from the government and private sector, see Table 3) to understand their role in the set up and implementation of the standard, as well as their perceptions on relevant challenges. Enumerators

surveyed (NPPO-registered) WPM treatment facilities using a detailed structured questionnaire (focusing on their operational characteristics, institutional support by other stakeholders and associated challenges).

<Table 3 about here>

Snowball sampling allowed the research team to expand the list of stakeholders based on recommendations from the ones initially identified (as in the case of informal pallet repair facilities or additional government agencies involved in compliance with the standard). This allowed for a more complete representation (and interactions) of all participants' socio-economic/institutional networks that were relevant for the successful implementation of the ISPM 15 standard (for the application of snowballing techniques as a means to expand one's study subjects based on their acquaintances, see Heckathorn, 1997; Scullion, Thomas, Vogt, Pérez-Maqueo, & Logsdon, 2011). The fieldwork took place in the four case-study countries between March 2015 and February 2016. A workshop in Nairobi, Kenya (20-21 July 2017) with representatives from the four country NPPOs and other stakeholders was used to validate the findings below.

Implementation Challenges

In this section we present the main results of our qualitative research based on our fieldwork and in-depth interviews. Overall, our findings point to several crucial malpractices that pose serious challenges to the successful implementation of the ISPM 15. While some of them are country-specific, in large these tend to be common across all four countries (see Table 4). These malpractices relate to the application of the ISPM 15 mark, lack of coordination across stakeholders, and institutional/capacity challenges both at the NPPO and treatment facility levels. These are discussed in more detail below.

<Table 4 about here>

Mark features and its application

According to ISPM 15, the mark must be durable, not transferable and legible, so that it is possible to trace WPM back to the facility which treated and marked it. In Cameroon, though, the mark does not bear a unique facility-specific code that allows to identify where the treatment took place. In contrast to the other three case study countries, the methyl bromide treatment facilities do not own a mark to use for their treated pallets, but the NPPO, instead, visits regularly the facilities and marks the pallets directly. Furthermore, the marks used in Cameroon often contain inessential components, beyond the requisite information. Quite often, the letters “DB” appear as part of the mark to signify that the wood is debarked; this information is not required as, by default, only debarked wood is used to produce wood packaging material. By random inspection at export facilities, we came across many cases of non-readable marks, which constitutes a problem common to all four countries. While the recent introduction of electric markers (in place of ink markers) has improved the readability of the mark, it still remains a widespread and systemic problem. Examples of incorrect mark application are shown in Figure 2.

<Figure 2 about here>

What appears to be an additional concern, especially in Botswana and Mozambique, is the widespread presence of informal repair facilities. These informal facilities are often located on busy urban roads and repair broken pallets by combining old treated material with potentially new untreated parts. As a result of this, the repaired pallets often bear old ISPM 15 marks, although a large part of them consists of untreated material (8). In many cases, pallets are reassembled from multiple sources; as a consequence, the repaired pallets bear multiple ISPM 15 marks (often from several countries, see Figure 3).

<Figure 3 about here>

Institutional/capacity challenges at the NPPO level

In Botswana, there is no institutionalized practice of regular audits by NPPO officials. In Kenya, the NPPO (KEPHIS) carries out inspections biannually, but these often tend to be quite informal visits rather than rigorous inspections of facilities and their practices. In some cases, poor implementation of the standard is simply due to sloppy practices. In Cameroon, for example, the NPPO has no up-to-date list of authorized treatment facilities; through our fieldwork it became apparent that 3 out of the 26 registered facilities have closed down in recent years, although the NPPO officials still include these in their list of authorized companies. Similarly, in Kenya, there have been some reported cases of formerly authorized treatment facilities still selling packaging material bearing the ISPM 15 mark, despite the fact that their license to treat WPM had not been renewed.

In the case of Mozambique, NPPO officials raised the lack of adequate resources in place (funding, skilled personnel) as a reason behind the poor implementation of the standard. They also claim that there is a high volume of unregistered exports to neighbouring countries which hinders monitoring the movement of associated WPM (and inspections at entry points). An additional issue of concern, although appearing to be Cameroon-specific, is the ambiguity regarding the ISPM 15 authorized types of treatment. While the official ISPM 15 recognizes only heat treatment and the use of methyl bromide as the only two approved types of treatment, the Cameroonian NPPO and Ministry of Agriculture and Rural Development (law number 3/2008) also authorize the use of PH₃ (phosphine) fumigation as an alternative option. During our field visit in Cameroon in July 2015, we found no evidence of WPM treatment based on phosphine fumigation. A manager of a treatment facility in Douala, though, mentioned that this is mainly due to practical issues; the PH₃ treatment requires a longer exposition time in comparison to methyl bromide.

Institutional/capacity challenges at the treatment facility level

Treatment facilities in the case-study countries often receive little guidance regarding the proper implementation of the standard and frequently end up interpreting the regulation falsely (10). In Cameroon, for example, there is often ambiguity regarding the amount of chemicals applied and the duration of treatment required to achieve compliance. Although the official ISPM 15 prescribes uniform treatment guidelines for all participating member countries around the world, several treatment facilities stated that they vary the amount of chemicals applied dependent on the destination of exported pallets. Concerning the length of the MB treatment, ISPM 15 only sets a minimum exposure time of 24 hours. Nevertheless, some facilities in Cameroon treat the wood packaging material for twice that length of time (although there is no evidence that lengthier exposure increases the effectiveness of treatment). In the same vein, in Kenya, there is misunderstanding regarding the time validity of the treatment; representatives of treatment facilities as well as of the NPPO believe that, contrary to what ISPM 15 stipulates, packaging material will need to be retreated after three months from the initial treatment.

In Botswana, there is only one ISPM 15-certified treatment facility that uses methyl bromide to treat packaging material. In the absence of heat treatment facilities and given the government's intention to gradually phase out the use of methyl bromide, the NPPO needs to support (financially/institutionally) the establishment of alternative HT units.

Coordination at the national level

Representatives of treatment facilities in Mozambique mentioned during our visit that the NPPO never offered any training to them on ISPM 15 implementation. Even in Botswana, where the treatment of WPM is centralized and only one treatment facility is currently operating, there is little interaction between the company and the national NPPO. A representative of the only methyl-bromide treatment facility highlighted that the company never received clear guidance from the NPPO regarding the

proper implementation of the ISPM 15. Similarly, in Kenya, key stakeholders (including the exporters and the treatment facilities) appear to be unaware of information material (mainly in the form of flyers and brochures) on ISPM 15 that the NPPO has produced.

What is even more worrisome is the inability of NPPO officials to enforce the standard implementation in some cases. In Cameroon, for example, 9 out of the 26 registered treatment facilities did not allow NPPO enumerators to visit their premises as part of the undertaken field work; in other words, these facilities demonstrated strong reluctance in sharing information with the NPPO, despite the supervisory function of the latter. In Mozambique, there seems to be very limited coordination between the NPPO and ministries that should have a strong interest in the successful implementation of the standard; interviews with representatives from the ministries of Agriculture, Forestry and Trade revealed that the latter were not aware of the existence of the ISPM 15, or the fact that the country was implementing it and its implications for pest control and trade.

In the case of Mozambique, there is evidence that excessive bureaucracy hinders the establishment of ISPM 15 compliant facilities. Interviewed representatives from a treatment facility in Maputo mentioned that the NPPO has not been able to process their application for an ISPM 15 license during a period of longer than two years. Another area that clearly demonstrates lack of coordination is the inspection of imported commodities and their wood packaging material. In Botswana, for example, neither customs nor the NPPO officials consider it their responsibility to enforce ISPM 15 for imports. The vast majority of Botswana's imports come from South Africa and, as a result of the Southern African Customs Union to which both countries belong, imported goods enter Botswana without any inspection of their wood packaging. A random inspection of trucks arriving in Botswana from South Africa revealed that some imported goods were transported on wooden pallets that did not bear the ISPM 15 mark (although the extent of this would require a much more detailed survey). In Cameroon, Kenya and Mozambique, NPPO inspectors examine only WPM used to import fruit and vegetables; all other imported goods are directly inspected by custom officials, who do not check for the ISPM 15 compliance of the associated wood packaging. Typically, there is little communication between

customs and NPPO officials and, as a result of this, the latter have limited information on whether wood packaging material has been used for the import of non-food consignments.

In the case of exports, trading firms often have inaccurate information regarding ISPM 15 and the NPPO lacks initiative in providing clarity. In Botswana, for instance, the Botswana Meat Commission (one of the largest exporting companies in the country) only buys brand-new treated pallets each time there is an overseas order. The company representative stated during our visit to the premises that they never use second-hand treated WPM, to avoid the risk of pallet re-infestation (despite the fact that ISPM 15 regulation prescribes that treated WPM does not need to be re-treated and that the risk of re-infestation is minimal). In contrast, another major exporting company in Botswana, the Kgalagadi Breweries, makes use of both treated and non-treated packaging material when transporting beer to South Africa and other neighboring countries.

Coordination at the international level

Some national implementing agencies (such as the Botswana NPPO) complained of not receiving appropriate training and capacity building support (regarding the implementation of the standard). The Botswana NPPO officials claimed that either the IPPC SECRETARIAT (FAO) or IAPSC should have organized such a workshop in the country; some concerns about IAPSC's role in facilitating the ISPM 15 implementation in the sub-Saharan region were also raised by the NPPO representatives in Mozambique. However, it should be noted that Botswanan NPPO officials were also unaware of available capacity building material and past opportunities for training (such as online documentation -especially the ISPM 15 Explanatory Document, see IPPC Secretariat (FAO, 2017)- and several previous workshops on ISPM 15, and in particular the initial 2005 workshop in Vancouver, Canada (11)).

Importing countries also seem to lack clarity regarding the effectiveness of different treatment methods, which creates unnecessary confusion and bureaucracy for the exporting firms in the four case-study countries. The Kephis (NPPO) officials in Kenya mentioned, for instance, that some

importing countries have a preference for methyl bromide treated packaging, while others for heat treated material; this was also brought up by some exporting firms in Mozambique. Moreover, Kephis has been requested in many occasions by importers to issue phytosanitary certificates verifying the ISPM 15 compliance of treated WPM.

Policy Insights and Recommendations

In this section we probe into policy insights and recommendations based on the implementation challenges identified in the preceding section. Table 5 provides a summary of policy recommendations, highlighting also the key stakeholders involved, as well as the type of necessary resources/interventions.

<Table 5 about here>

Mark features and its application

The practice of the NPPO marking pallets directly in Cameroon does not contradict the requirements set out by the ISPM 15 (i.e. the NPPO is entitled to keep all stamps and apply them upon completed treatment). However, the NPPO practice of using a single stamp for all facilities prevents identifying the facility which treated a specific pallet. In addition, this is contradicting not only the ISPM 15 but also Cameroon's national legislation (namely, the Ministry of Agriculture law 3/2008, which prescribes that the producer/treatment provider code should be unique for each authorized WPM treatment facility). Furthermore, the misunderstanding on the essential information the mark should contain in Cameroon may be related to how the Ministry of Agriculture misinterprets ISPM 15. More specifically, the Ministry of Agriculture Law 3/2006 states that the mark should also present the date of treatment

and the code of the institution in charge of marking; these are features that are not required by the official ISPM 15.

Another issue of concern is the lack of oversight of the use of the ISPM 15 mark as it is easy to replicate, which could potentially lead to fraudulent marks applied to non-compliant or non-treated WPM (Baksi & Bose, 2007) if the use of the mark is not monitored. However, if the NPPOs regularly monitored the use of the mark and withdrew the authorization if not used properly, misuse could be limited. There is also no prescribed regulation regarding the size of the mark, which would have facilitated the identification of fraudulent behavior. Nevertheless, the interviewed firm representatives (owning ISPM 15 marks) in all four countries were not aware of any incidences of external replication of their mark; the latter claim needs to be taken with a pinch of salt given the current difficulties NPPO officials face in verifying the authenticity of each mark.

The practice (of informal repair facilities in Botswana and Mozambique) of reassembling pallets from old broken parts makes it impossible to attribute the pallet during an intervention to a specific treatment facility. Naturally, these repaired pallets pose a risk to the successful implementation of the standard (and, ultimately, to a successful reduction of WPM infestation rates). On a more encouraging note, the interviewed representatives of the informal repair facilities claim that the vast majority of their pallets are purchased for domestic use (limiting hence the prospects of cross-boundary infestations).

To address these issues, the following policy recommendations should be adopted. NPPOs should require all authorized treatment facilities to use a unique, identifiable code so that improper treatment can be traced back to facilities that are not meeting ISPM standards (potentially unknowingly releasing pests). In addition, they should provide clarity regarding the essential components of the mark, so that there are no inconsistencies across countries (FAO-IPCC could also recommend a revision that adopts the Cameroon-specific practice of including the date of treatment, which would facilitate the tracing of WPM). Training on the proper application of the stamp (by NPPO

officials) and regulations that prescribe the sole use of electric markers can improve the readability of the mark. Rigorous record keeping (e.g. in the form of maintaining a database of treated WPM, shared across treatment facilities, inspectors and NPPOs) may prevent the circulation of fraudulent WPM. NPPOs also need to regulate more closely the informal repair facilities and adopt best-practices found in developed economies (where old marks on repaired pallets need to be covered in paint, and only then the ‘new’ mark is applied to the treated repaired WPM, see Park, Horvath, & Bush, 2018).

Institutional/capacity challenges at the NPPO level

Our fieldwork and interviews with representatives of NPPOs and treatment facilities made apparent that there are often limited quality control mechanisms in place to ensure fully-compliant WPM treatment (9). The ISPM 15 explicitly stipulates that “NPPOs that authorize the use of the mark should supervise (or, as a minimum, audit or review) the application of the treatments”. However, lack of adequate resources (especially in terms of skilled personnel) is often to blame for poor auditing practices. In several occasions, though, the concerns relate to sloppy practices than can be rectified with few additional resources (as in the case of keeping an up-to-date register of treatment facilities or explicitly specifying the list of authorized types of treatment). Furthermore, national NPPOs should provide clarity to the authorized WPM treatment facilities on the frequency and the content of their audits; occasional unannounced audits are likely to be more effective in assessing the compliance of the corresponding facility. The earlier recommendation of a proper registration of WPM (with date of treatment, unique treatment facility ID etc) should also be promoted by NPPOs in a coordinated, organized policy effort that prevents the cross-border transfer of non-compliant WPM.

Institutional/capacity challenges at the treatment facility level

Ambiguities regarding the amount of chemicals needed (dependent on the destination of pallets) and the time validity of the treatment suggest that there is an urgent need for clarifications given by NPPOs,

as well as coordination action with trade partners (that should not request stricter regulations beyond the ones prescribed by ISPM 15). Additional funding and training should also facilitate the establishment of heat treatment facilities in countries where methyl bromide is gradually phased out.

Coordination at the national level

The need to strengthen coordination across key national stakeholders appears to be a common challenge across all four case-study countries (and a common prerequisite for the successful implementation of most certification schemes, see Gebreeyesus, 2015). An appropriate policy recommendation would be to standardize communication materials (and/or dissemination practices) across participating countries. Regular visits by NPPO to treatment facilities, or gathering representatives for specific training sessions, seems necessary for the dissemination of information on proper WPM treatment. There should be sanctions (e.g. withdrawal of permits, confiscation of stamps) for treatment facilities that fail to cooperate (by either obstructing audits or by not providing adequate information on treated WPM) or do not make correct use of the approved types of treatment. In addition, NPPOs should set up coordination activities (annually or more frequently if necessary), where representatives from the NPPO, other government ministries, treatment facilities and the industry meet to exchange information on best practices, concerns and possible solutions. NPPOs should also set specific time limits (targets) by which applications for an ISPM 15 license is either issued or renewed (once all requirements are met). Excessive bureaucracy creates additional costs for the industry – in Mozambique, for example, delays in licensing and the associated shortage of ISPM 15 registered facilities force many exporting firms to purchase treated packaging material at a higher cost from neighboring South Africa or Swaziland.

Another important policy recommendation relates to the strengthening of coordination at the level of inspection of imported commodities (and the associated WPM). This involves a clear division of roles and responsibilities across NPPO and customs officials, provision of additional funding and

personnel so that all WPM is inspected (rather than only the one used to transport fruit and vegetables). While the risk of pest infestation when importing/exporting goods and WPM from neighboring countries (with similar agro-ecological settings) might be lower, effective pest management at a larger scale is hampered in the absence of regular checks on traded commodities.

Coordination at the international level

Coordination at the international level (NPPOs, IPPC SECRETARIAT (FAO), IAPSC, exporting sector) can be strengthened in several areas. IAPSC (and IPPC SECRETARIAT (FAO)) should regularly update NPPO officials on available capacity building material and opportunities for training (through policy briefs, regional workshops etc). IAPSC should also help develop a regional strategy, with common regional guidelines for all its member countries regarding implementation (and within this regional strategy, each NPPO should develop national legislation to support the correct implementation of ISPM 15 and advise national stakeholders on actions to be taken). The earlier policy recommendation of notifying IPPC SECRETARIAT (FAO) and NPPOs in cases where importing firms/governments misinterpret ISPM 15 is also relevant here. NPPOs should reach to importing firms that discriminate in favor of a particular treatment method (and emphasize that both HT and MB treatments are considered to be equally effective under the ISPM 15). Similarly, any additional bureaucratic procedures (as in the case of issuing phytosanitary certificates that accompany treated WPM) should be abolished (given that the mark is sufficient to signify compliance); the earlier suggestion of a digital recording of all treated WPM (in the form of a database accessible to key domestic and international stakeholders) will further strengthen compliance.

Conclusions

This paper provides a novel in-depth analysis on the implementation challenges of the ISPM 15 in the context of sub-Saharan Africa. Based on fieldwork in 2016-7 in Botswana, Cameroon, Kenya and

Mozambique (and a series of in-depth interviews with several key stakeholders) we carried out a thorough review of associated procedures and common practices in place, with particular emphasis on issues of compliance across all actors in the WPM value chain. We identified a number of malpractices that pose serious challenges to the successful implementation of the ISPM 15 and drew corresponding policy recommendations. While the NPPOs of the four countries involved are the primary target of these recommendations, we envisage that many other NPPOs (both located in the sub-Saharan region but also elsewhere, especially in emerging and developing economies) are likely to face same or very similar challenges and, hence, find our policy recommendations useful.

Existing research on ISPM 15 is still at the anecdotal stage; our comparative analysis provides some first useful insights on challenges related to the standard implementation and compliance. Our study had a sub-Saharan Africa focus and future research could extend the analysis to other parts of the world in search of evidence of commonalities, differences and additional best practices. We identified a number of areas where interventions are necessary for the proper implementation of the standard: these include institutionalized coordination meetings of key stakeholders, rigorous record keeping of all treated WPM, sanctions for non-compliance, clarification on approved types of treatment and mark components, simplifications of bureaucratic processes for ISPM 15 licenses and more thorough inspections of WPM at entry points. These measures are pivotal in reducing the risk of cross-border pest movements that can cause severe damages to local ecosystems, result in substantial decline of agricultural yields and threaten the local livelihoods of rural populations. Future research in the field of impact evaluation should assess how the adoption of specific policy recommendations (across the lines suggested above, and possibly within an experimental setting of treatment and comparison groups) can increase ISPM 15 compliance. In addition, cost-benefit analysis should highlight, in monetary terms, the associated costs and benefits of compliance, as well as the distributional implications thereof; given that these are likely to vary substantially across countries, this type of cost-benefit analysis should produce a methodological tool that could be easily adopted in different country contexts with little effort.

Notes

1. IPPC is an international treaty which facilitates cooperation across contracting parties -138 so far- with the objective of protecting the world's cultivated and natural plant resources from the spread and introduction of pests of plants. The complete list of all adopted standards is available at the IPPC website: <https://www.ippc.int/en/core-activities/standards-setting/ispms/#publications> lastly accessed the 05/04/2018.
2. Prior to the 2009 revision, there was a slight ambiguity regarding the exact objective of the standard, with official documentation stating that the scheme's purpose was to “practically eliminate the risk for most quarantine pests and significantly reduce the risk from a number of other pests that may be associated with WPM”. The change in the wording recognized that the objective of the standard is to manage the risks of pests present in the wood; contaminating pests are not covered by the standard and, generally speaking, do not pose a risk. Should countries wish to manage those pests, they would need to conduct a pest risk assessment and enact appropriate requirements to manage the risks.
3. The use of MB has been banned in Cameroon since 2016.
4. The effectiveness of the treatment can be verified with the use of measuring devices in the treatment chamber. However, these measuring devices are expensive and require technical skills, limiting hence their use in developing countries.
5. ISPM 15 does not specify in detail the inspection requirements, which are determined directly by the national auditing agency.
6. For more information about the role and the objectives of the IAPSC, see <https://www.ippc.int/en/external-cooperation/regional-plant-protection-organizations/interaficanphytosanitarycouncil/> and <https://iapsc-au.org/en> (accessed on 26/03/2018).
7. For more information about the support EPPO provides to its member states, see www.eppo.int.

8. It is worth-noting that ISPM 15 regulations allow broken wood packaging material to be repaired, as long as each added component is treated and marked in accordance with the standard.
9. The issue of quality control and monitoring is identified as a common problem in the broader literature on environmental labelling schemes, see Ward (2008).
10. There is a large literature on the role of informational barriers in the successful implementation of several environmental schemes, e.g. see DeAngelo and Nielsen-Pincus (2017).
11. For more information see: <https://www.ippc.int/es/core-activities/capacity-development/application-of-isp-15/ippc-workshop-practical-application-isp-15-vancouver-canada-28-february-4-march-2005/>

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Other Explanatory Documents are available at: <https://www.ippc.int/en/coreactivities/standards-setting/explanatory-documents-international-standardsphytosanitary-measures/> and at <https://www.ippc.int/en/core-activities/standardsand-implementation/application-of-isp-15/>.

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Tables and Figures

Table 1: Timeline of significant ISPM 15 milestones

2002	2003	2006	2009	2010	2013
ISPM 15 is (Guidelines for regulating wood packaging material in international trade) is adopted	The mark is modified and the original symbol of a bug with a diagonal line is replaced with a symbol of a stylized stack of lumber	First revision of the ISPM 15 takes place. Changes adopted in relation to the duration and temperature of methyl bromide (MB) treatment (minimum exposure time for MB extended to 24 hours)	Changes regarding heat treatment (HT) of WPM (30 continuous minutes throughout the entire profile of the wood). Treatment necessary also for repaired and remanufactured WPM	EU prohibited the use of MB within the EU	Introduction of the dielectric heating (DH) treatment

Source: Authors' elaboration.

Table 2: Summary details of implementation process in the four countries

Country	National law on ISPM 15 implementation	Official Treatment used	Guidelines on how to inspect the goods	Good inspections at the entry and at the exit enforced
Botswana	Plant Protection Act of 2009	MB	Not available	Rarely
Cameroon	003/06/A/MINADER/SG/DR CQ/SDRSQV/SQV	MB and HT	Present	Enforced for phytosanitary goods
Kenya	KEPHIS Act No.54 of 2012	MB and HT	Not available but in the pipeline	Enforced for phytosanitary goods
Mozambique	Not available	HT	Present	Enforced for phytosanitary goods

Table 3: List of interviewed stakeholders

Stakeholders	Botswana	Cameroon	Kenya	Mozambique
Government related organizations	National Plant Protection Organization, Ministry of Agriculture (Crop Production Department), Meteorological Services, Ministry of Forestry, Customs police	National Plant Protection Organization, Ministry of Agriculture, Ministry of Forest and Fauna, Phytosanitary Police Post, Trade Facilitation and Transport Observatory, Customs police	National Plant Protection Organization, Ministry of Industrialization and Enterprise Development, Ministry of Environment, Water and Natural Resources, National Environment Management Authority, Pest Control Products Board , Port and airport customs police	National Plant Protection Organization, Ministry of Agriculture, Ministry of Forestry, Ministry of Soil, Environment and Rural Development, Ministry of Trade, Port customs police
International organizations		Inter African Phytosanitary Council, Food and Agriculture Organization of the United Nations		United Nations Industrial Development Organization
WPM treatment facilities	Methyl bromide treatment facility	Heat treatment facilities, Methyl bromide treatment facilities	Heat treatment facilities, Methyl bromide treatment facilities	Heat treatment facilities
WPM related businesses	Pallet Manufacturers, Pallet repairers	Pallet Manufacturers, Pallet repairers	Pallet Manufacturers, Pallet repairers	Pallet Manufacturers, Pallet repairers
Exporters	Meat exporter, Beer exporter	Fruit and vegetables exporters	Fruit and vegetables exporters, Tea exporter	Banana exporters

Table 4: Implementation challenges

	Botswana	Cameroon	Kenya	Mozambique
Mark features and its application	— —	— —	—	— —
No unique treatment facility code		—		
Inclusion of inessential elements		—		
Readability	—	—	—	—
Presence of informal repair facilities	—			—
Institutional/capacity challenges (NPPO)	—	— —	— —	—
Regular audits	—		—	
Accurate list of treatment facilities		—	—	
Inadequate resources				—
Ambiguity regarding types of treatment		—		
Institutional/capacity challenges (treat. facility)	—	—	—	
Treatment duration / amount of chemicals		—		
Time validity of treatment			—	
Exclusive reliance on MB	—			
Coordination at the national level	— —	— —	— —	— —
Treat. facilities and NPPO assistance/training	—		—	—
Treat. facilities and NPPO inspection		—		
Licensing of treat. facilities and NPPO				—
Coordination between NPPO and other ministries				—
Coordination regarding imported WPM	—	—	—	—
Coordination regarding exported WPM	—			
Coordination at the international level	—	—	—	— —
Coordination between NPPOs and IAPSC	—			—
Coordination between treat. facilities and foreign importers			—	—

Note: — — identified challenges in more than one subcategory. — identified challenges in one subcategory.

Table 5: Policy Recommendations

List of recommendations	Implementation Challenge Addressed	Actors Involved	Type of Necessary Resources
Unique, identifiable code per treatment facility	Mark features and its application	NPPO, treatment facilities	New regulations
Clarifications on essential mark components (and inclusion of date of treatment)	Mark features and its application	FAO-IPCC, NPPO, treatment facilities	New regulations
Training on the proper application of the stamp and exclusive use of electric markers	Mark features and its application	NPPO, treatment facilities	Training, new regulations
Rigorous record keeping (database)	Mark features and its application; Institutional/capacity challenges at the NPPO level	NPPO, treatment facilities	Funding, training, in-house facility resources
Monitoring of informal repair facilities	Mark features and its application	NPPO, informal repair facilities	New regulations, extra NPPO staffing
Regular and rigorous inspections of treatment facilities	Institutional/capacity challenges at the NPPO level	NPPO, treatment facilities	Extra NPPO staffing
Clarification on authorized types of treatment	Institutional/capacity challenges at the NPPO level; institutional/capacity challenges at the treatment facility level, coordination at the international level	NPPO, treatment facilities, exporting firms, IPPC SECRETARIAT (FAO)	Information campaign, coordination with trade partners
Funding and training for HT facilities when MB is phased out	Institutional/capacity challenges at the treatment facility level	NPPO, treatment facilities	Funding, training
Standardization of communication materials (and/or dissemination practices)	Coordination at the domestic level, coordination at the international level	NPPO, treatment facilities, industry, IPPC SECRETARIAT (FAO), IAPSC	Funding, information campaign
Sanctions for treatment facilities that fail to cooperate	Coordination at the domestic level	NPPO, treatment facilities	Legislation
Institutionalized coordination meetings where stakeholders exchange information on best practices, concerns and solutions	Coordination at the domestic level, coordination at the international level	NPPO, other government ministries, treatment facilities, industry, IPPC SECRETARIAT (FAO), IAPSC	Funding
Specific time limits by which applications for an ISPM 15 license is issued/renewed	Coordination at the domestic level	NPPO, treatment facilities	New regulations

More rigorous inspections of imported WPM	Coordination at the domestic level	NPPO, customs, exporting firms	Funding, additional personnel, clear division of roles
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Figure 1: Example of ISPM 15 mark



Source: IPPC (2009).

Figure 2: Irregular marks



Source: Photographs taken during visit to Kenyan export facilities.

Figure 3: Informal repair facilities



Note: (Left) Reassembled WPMs, containing potentially both non-treated parts, as well as treated parts bearing the ISPM 15 mark. (Right) Treated parts of WPM aimed to repair broken pallets. Source: Photographs taken during visit to informal repair facilities in Botswana.